GIS Odyssey Journal

2026 • Volume 6 • Number 2

https://doi.org/10.57599/gisoj.2026.6.2.5

Taiye Oluwasola Babatunde[1], Oluyemisi Omowumi Babatunde[2], Fatai Abiola Azeez[3], Ganiyat Bello Kabir[4]

TECHNICAL EFFICIENCY AND ECONOMIC PERFORMANCE OF WOOD PRODUCTION IN IKIRE IREWOLE LOCAL GOVERNMENT AREA OF OSUN STATE

Abstract: This study evaluated the technical efficiency and profitability of wood production in Ikire Local Government Area using data from 90 respondents selected through a multistage sampling technique. Data were collected with structured questionnaires and analyzed using descriptive statistics, budgetary analysis, and Stochastic Frontier Analysis (SFA). Budgetary analysis revealed that wood marketing is profitable, with total revenue exceeding total costs and a return on investment ranging from 2.4 to 3.1. The stochastic frontier model produced a mean technical efficiency score of 0.82, indicating that marketers operate at 82% of their production potential, leaving an 18% improvement margin. Technical efficiency ranged from 0.60 to 0.95, reflecting differences in resource utilization among marketers. Labour (0.310), capital (0.401), and processing cost (0.291) significantly increased output, while increasing age reduced efficiency. Marketing experience and education positively influenced technical efficiency. The major constraints identified were inadequate electricity supply and high transportation costs (98.9%), limited wood species availability (86.7%), and poor access to credit facilities (85.6%). The study concludes that wood marketing is profitable but has considerable potential for improved efficiency. It recommends strengthening electricity infrastructure, improving access to affordable credit, and providing capacity-building programmes to enhance technical efficiency and profitability.

Keywords: wood production, wood market, Ikire

Received: 31 March 2026; accepted: 1 July 2026; revised: 11 July 2026

© 2026 Authors. This is an open access publication, which can be used, distributed and reproduced in any medium according to the Creative Commons CC-BY 4.0 License.

[1] Federal College of Forest Resources Management Fugar ,Edo State, Nigeria, ORCID ID: https://orcid.org/0000-0003-4196-2380, email: sollybee2012@gmail.com
[2] Federal College of Forestry, Department of Statistics, Ibadan, Nigeria, ORCID ID: https://orcid.org/0000-0003-4698-4511, email: oluyemisibabatunde@gmail.com
[3] Federal College of Forestry, Department of Agricultural Business and Management, Ibadan, Oyo, Nigeria, ORCID ID: https://orcid.org/0000-0002-2153-7494, email: fazeez2013@gmail.com
[4] Forestry Research Institute of Nigeria, Ibadan, Oyo, Nigeria, ORCID ID: https://orcid.org/0009-0007-9191-1019, email belloganiyah263@gmail.com

Introduction

The forestry and wood marketing industry is still very important for economic growth in Nigeria, especially in areas that have a lot of forest resources, like Oyo State. Wood products like timber, planks, poles, and fuel wood are very important for building structures, making furniture, and providing energy for home use (Olorunisola, 2022). These products serve as the foundation of many local economies, with wood markets acting as key centers connecting forest resources to end users. In the southwest part of Nigeria, wood markets play a big role in creating jobs, earning income and helping rural areas grow. This happens through various changes in the wood industry like cutting trees, turning them into useful products, moving them around, and selling them (Olawunmi & Okunola, 2015; Adaaja et al., 2024; Babatunde et al., 2017; Babatunde et al., 2021). A forest is a large area of land covered primarily by trees and other plant, fulfilling essential ecological, economic, and social functions. The world, forests are identified using factors like forest tree density, how tall they are, how the land is used, and what role they play in the environment.

Recent global studies showed that forests cover billions of hectares and play a key role in supporting wildlife, climate production and providing resources for the industries (Food and Agriculture Organization, 2020). In Nigeria, the forests have a wide variety of plants and animals, which make them important for producing wood and others that are forest dependent (Akindele & LeMay, 2021). Timber, which is wood processed form suitable for construction, carpentry, and industrial use, has been a vital m aterial for human development throughout history. It is commonly used in building construction for parts like beams, roofs, walls, and floors. Timber is still a widely used material for building homes and other structures because it is easily available and can be used in many different ways (Ojo & Adekunle, 2022; Johnson et al., 2013; Aina & Salau, 2023). The ongoing dependence on wood products underscores the need to enhance efficiency in the timber industry to satisfy increasing demand while reducing waste.

Technical efficiency is an important idea when looking at how well wood markets and forestry companies are doing. It refers to the ability of producers or marketers to achieve maximum output from a given set of inputs (Olagunju & Salman, 2022). In the wood market, this means getting the wood from the trees, preparing it, moving it around, and delivering the finished wood products efficiently. Studies in forestry show that many people working in the wood industry aren't as efficient as they could be. This is because they often face problems like not having enough money to borrow, using old machinery, and not having enough training or knowledge (Gbigbi et al, 2024; Ogunjinmi & Aiyeloja, 2021). Access to credit has been shown to significantly enhance profitability and marketing efficiency among sawn wood marketers, emphasizing the importance of financial support in improving efficiency (Gbigbi et al., 2024).

Marketing efficiency helps determine how well resources are used during the distribution of wood products. It is important because it ensures that products reach consumers at the lowest possible cost while helping marketers get the best possible return on their investments (Olatunji & Idris, 2024). High marketing efficiency is linked

to more effective pricing, less waste, and higher incomes for stakeholders in the wood value chain. High marketing efficiency is linked to more effective pricing, less waste, and higher incomes for stakeholders in the wood value chain (Akinyemi & Oladipo, 2023; Cumming ham, 2005). Besides facing economic issues, Nigeria's forestry sector also has major environmental problems, like deforestation and the way trees are cut down without enough care. Recent studies indicate that forest resources are increasingly being used for revenue generation with insufficient focus on regeneration and sustainability Ogunwusi, 2020). This situation highlights the need for enhanced efficiency in resource use to balance economic benefits with environmental conservation. Using good forestry methods along with effective market systems is important for making sure there will always be enough wood available in the future.

However, just like many wood markets in Nigeria, they may encounter problems such as poor efficiency, lack of proper facilities, and not having enough money or expert help. Even though wood markets are important, there isn't much real data about how efficient they are technically and how well they perform economically in this area. Because of that, this study looks closely at the technical efficiency and economic performance of wood markets in Ikire Local Government Area of Oyo State. The study seeks to evaluate the efficiency of resource utilization, identify factors affecting efficiency, and assess the profitability of wood market activities.

Materials and methods

Study area description. Ikire is a well-known town in the southwest part of Nigeria and acts as the main administrative center for Irewole Local Government Area. The town is located in Osun State and is situated near Ibadan, which is a major commercial hub in the area. Its location along the Ibadan–Ife expressway enhances its accessibility and facilitates the movement of goods and services between Osun and neighboring states, including Oyo State. Geographically, Ikire is situated around latitude 7°25′–7°30′ North and longitude 4°13′–4°20′ east. The region has a tropical climate with clear wet and dry seasons, which helps grow crops and support tree planting. The area's plants are part of the rainforest region in southwestern Nigeria, which makes it good for growing both types of forest products those that are wood-based and those that are not. The population of Ikire and nearby villages was counted as more than 140,000 people according to the country's official population survey. The population is primarily composed of the Yoruba ethnic group and is mainly engaged in farming, trading, and small-scale industrial activities. Major crops grown in the area include cocoa, cassava, yam, maize, and palm produce, which play a significant role in the local economy. Administratively, Irewole Local Government Area consists of several communities such as Arinkin, Ayetoro, Wasinmi, and others, with Ikire serving as the central hub for governance and commerce. The local government helps lead development efforts and works to organize the area's economy. Ikire is known for having a lively market and lots of business activity. The town serves as a place where agricultural and forest goods, like timber and fuel wood, are gathered and sent out. Having active markets and being close

to cities helps improve trade chances and supports the growth of businesses that use wood. This makes Ikire a key place to study wood markets because it shows how forest resources are connected to the needs of the city. Also, the presence of forest resources and farm products has led to the growth of businesses like sawmilling, timber trading, and selling firewood. These activities offer employment and income opportunities for many households in the area, thus aiding in poverty reduction and promoting economic development. However, similar to many developing regions, challenges such as insufficient infrastructure, restricted access to modern equipment, and poor resource utilization may impact the performance of these enterprises.

Sampling technique and sample size. A multistage sampling method was used for this study. In the first stage, Ikire in Irewole Local Government was chosen on purpose because it is actively involved in wood processing and selling, and there are many sawmills in the area. In the second stage, Orisunmbare sawmill was purposively chosen because it is a prominent and well documented sawmill located in Ikire. In the third stage, ninety wood marketers were chosen randomly from the sawmills. In total, ninety respondents were selected and given structured questionnaires in the study area to gather data.

Analysis. The data was analyzed using descriptive analysis, Stochastic Frontier Production Function, and budgetary evaluation.

This following profitability measures were calculated:

"RMCF= TVP-TC ……." (1)

"RRTI=100" ("RMCF"/"TC") ……." (2)

"GM= TR-TVC ……." (3)

"RRFC=100" ("RFC"/"TFC") ……." (4)

Profitability ratios

Rate of return (ROR) and Rate of return on investment (RORI) are two alternative profitability measures that was used in comparing the extent of profitability in the study area.

Rate of Return (ROR %.) ="TR" /"TC" "X" "100"/"1" (5)

ii. Rate of Return on investment (RORI %) = "TR-TC" /"TC" "X" "100"/"1" (6)

Where:

RMCF = Return to management capital and family labour or net income

TVP = Total value product

TVC = Total variable cost (₦)

RRTI = Rate of Return on investment

TC = Total cost (Gross margin) (₦)

RFC = Return on fixed cost (Gross margin) (₦)

RRFC = Rate of return on fixed cost

The technical efficiency of the smallholder wood marketers was estimated by Stochastic Frontier Production Function .The model is specified explicitly as below:

$$LnQ1=\beta0+\beta1\ LnX1 + \beta2LnX2 +\beta3LnX3 + \beta4LnX4 +\beta5LnX5 + \beta6LnX6 + Vi - Ui \quad (7)$$

Where:

Qi = Log output

X1 = Labour cost (₦)
X2 = Capital (₦)
X3 = Transportation cost (₦)
X4 = fuel (liters)
X5 = Processing cost (₦)
X6 = Maintenance cost (₦)
β0 = Intercept
Bi – β6 = Coefficients of the independent variables
Estimated
Vi = Random error

In order to determine the factors that directly contribute to technical inefficiency in wood marketers production, the following model was estimated:

$$Ui = \alpha 0 + \alpha 1 z1 + \alpha 2\, z2 + \alpha 3\, z3 + \alpha 4\, z4 + \alpha\, 5\, z5 + \alpha\, 6\, z6 \quad (8)$$

Where:
Ui = Technical inefficiency estimate of the wood marketers
Z1 = Years of formal education of the farmer (i.e. years spent in school)
Z2 = Age of the farmer (years)
Z3 = Gender (Male = 1, otherwise = 0)
Z4 = Years of experience
Z5 = Marital status
Z6 = Access to credit (Yes = 1; otherwise, 0)
μ = Random error component

Results

Table 1 presents the socioeconomic characteristics of wood marketers; including age, gender, education level, number of workers, and other relevant factors influencing their livelihoods.

The Timber business socioeconomic characteristics showed that, with a mean age of 43.4 years, the majority (49%) were in the 41–50 age range. The fact that 54% of the respondents were female suggests that women are heavily involved in wood marketing. Regarding transportation, 56% of the respondents used trucks, while 42% relied on lorries for carrying wood goods. The results also revealed that, with a mean business experience of 7.4 years, 42% of the respondents had been in the industry for 7–9 years. According to the respondents' educational attainment, 57% had finished secondary school and 11% had completed postsecondary education. Additionally, the study found that 55% of the respondents had five to seven employees, with an average of 6.1 employees per company. The predominance of private entrepreneurship in the wood marketing industry is demonstrated by the fact that 99% of the respondents ran privately held businesses. Lastly, the projected mean operational capital was ₦587,778, whilst 48% of the respondents had company capital between ₦300,000 and ₦500,000.

Table 1. Socioeconomic Characteristics of Respondents in the study area

Variables	Frequency (n)	Percentage (%)	Mean
Age (years)			**43.4 years**
Below 30 years	9	10.0	
31–40 years	27	30.0	
41–50 years	44	49.0	
Above 51 years	18	20.0	
Gender			–
Female	49	54.0	
Male	41	46.0	
Means of Transportation			–
Truck	50	56.0	
Lorry	38	42.0	
Car	2	2.0	
Years of Establishment			**7.4 years**
1–3 years	8	9.0	
4–6 years	20	22.0	
7–9 years	38	42.0	
Above 10 years	24	27.0	
Educational Background			–
No formal education	3	3.0	
Primary school	24	27.0	
Secondary school	51	57.0	
Tertiary education	10	11.0	
Number of Workers			**6.1 workers**
1–4 workers	13	14.0	
5–7 workers	50	55.0	
8 workers and above	26	29.0	
Nature of Business			–
Private	89	99.0	
Public	1	1.0	
Business Operational Capital (₦)			**₦587,778**
Below 300,000	6	7.0	
300,000–500,000	43	48.0	
500,000–1,000,000	32	36.0	
Above 1,000,000	9	9.0	

Source: own research based on field survey, 2026

Discussion

Socioeconomic results. This suggests that the majority of respondents were in their productive and economically active years, which can have a favorable impact on company success. Individuals within this age bracket frequently possess extensive marketing expertise, bigger business networks, and superior negotiation abilities that boost client retention and corporate efficiency (Adeogun et al., 2020). Older marketers also tend to have stronger ties with suppliers and purchasers, resulting in more steady sales and consistent cash flow (Donkor et al., 2021).

According to research on informal markets, women's involvement boosts household income and increases market diversity (Akanbi & Akande, 2019). According to Adeniran et al. (2022) female traders also have a tendency to reinvest a significant amount of their revenues into their enterprises and household welfare, which strengthens family livelihoods and enterprise sustainability.

According to Agwu et al. (2019), merchants can increase sales and profitability by expanding their market reach, decreasing delivery delays, and improving customer satisfaction through efficient transportation. Access to commercial trucks also helps marketers to carry larger volumes of wood and negotiate better rates, resulting to improved business returns (Eze et al., 2020).

This implies that the majority of marketers had built solid firms and gained a great deal of experience. Longer years of operation are connected with better customer loyalty, stronger market reputation, and improved financial performance (Babatunde & Ayanwale, 2021; Babatunde et al., 2017). Experience also helps marketers' capacity to react to changing market conditions and sustain corporate operation.

This shows that most have received a minimal formal education, which is necessary for managing finances, keeping records, setting prices, and interacting with customers. In general, educated marketers are more inclined to embrace better business practices and spot chances for company growth (Chukwu et al., 2020; Ibrahim & Aliero, 2019).

This implies that the majority of wood marketing businesses are medium-sized and have enough workers to manage loading, processing, shipping, and customer support. Having a sufficient workforce helps firms meet consumer demand quickly, enhances operational efficiency, and boosts productivity and profitability (Olajide & Adeoye, 2021).

Private ownership promotes adaptability, speedy decision-making, and creativity, allowing marketers to react quickly to market possibilities and shifting consumer needs (Osabohien et al., 2019). This suggests that the majority of dealers have a decent amount of money to sustain their business. Adequate capital enables marketers to acquire bigger amounts of wood, enjoy bulk purchase discounts, maintain inventories, and pay operating expenses, all of which contribute to enhanced profitability and business growth (Ogunniyi et al., 2021; Taiwo & Afolabi, 2022).

Profitability performance of timber business (2021–2025). The income, expenses, profit margins, and financial difficulties that plank dealers encounter are all examined in the Table 2 which also looks at the budgeting aspects of the business.

The budget analysis for the five years between 2021 and 2025 demonstrates how plank vendors manage expenses, generate revenue, and receive returns on their fixed assets and overall investment. The overall profitability and operational sustainability of the company are indicated by the movements in important financial metrics. Variable costs are expenses that fluctuate with the level of business activity, such as transportation, labor, fuel, maintenance, processing, and taxes.

Table2. Profitability Analysis of Timber business in the study area

Variable / Cost Type	**2021**	**2022**	**2023**	**2024**	**2025**
Variable Costs					
Transportation	5,628,000	6,690,000	7,950,000	8,748,000	6,636,000
Labour	892,680	1,028,100	1,103,340	1,234,080	1,365,600
Fuel	6,697,800	1,758,108	8,886,000	6,852,000	8,022,000
Maintenance	1,186,800	349,650	1,122,000	334,800	1,000,200
Rent	31,200	31,800	32,400	32,400	32,400
Processing	6,732,000	7,962,000	8,628,000	9,588,000	10,194,000
Taxes	15,000	15,000	15,000	18,000	18,000
Total Variable Cost	21,383,480	17,834,658	27,736,740	26,766,280	27,268,200
Fixed Costs					
Depreciation: Saw machine	964,401	964,401	964,401	964,401	964,401
Depreciation: Generating set	633,705	633,705	633,705	633,705	633,705
Depreciation: Vehicle	282,315	282,315	282,315	282,315	282,315
Total Fixed Cost	1,880,421	1,880,421	1,880,421	1,880,421	1,880,421
Total Cost (Variable + Fixed)	23,263,901	19,715,079	29,617,161	28,646,701	29,148,621
Total Revenue	63,360,000	75,240,000	68,520,000	90,720,000	90,720,000
Profit (Revenue – Total Cost)	40,096,099	55,524,921	38,902,839	62,073,299	61,571,379
Rate of Return on Investment (ROI)	2.75	3.82	2.31	3.16	3.11
Rate of Return on Fixed Cost (ROFC)	33.7	44.3	36.5	47.5	48.2

Source: own research based on field survey, 2026

The variable cost varied from ₦17,834,658 to ₦27,736,740 between 2021 and 2025. Variable costs typically increased or decreased throughout this period based on how the fimrs expanded, indicating how much was produced and how busy the operations were.

Additionally, steady constant expenses show that the capital investment is still profitable and doesn't need to be replaced. The sum varied from ₦19,715,079 to ₦29,617,161 per year. Total income is the money gained by selling planks, which was between ₦63,360,000 to ₦90,720,000. Over time, revenue rose, particularly in 2022 and 2024, indicating that either the prices increased or more planks were sold Return on Fixed Cost (ROFC), a measure of profit from fixed assets, ranged from 33.7% to 48.2%. From 2021 to 2025, the trend has been increasing, meaning that each unit of fixed assets is now producing more money than before productivity from fixed assets.

Discussion of profitability result. The variable expenses were lower in 2022 than in 2021, possibly due to better cost management or less expensive supplies, but they significantly increased in 2023 as the company grew. These kinds of trends frequently occur in rapidly expanding small firms. In these enterprises, the costs can alter based on how much work is being done and what's happening in the market (Agwu & Emeti, 2019; Eze et al., 2020). The constancy of fixed expenses implies that the organization has not regularly bought or disposed of important assets during these years, aiding in predictable expenditure planning (Taiwo & Afolabi, 2022).

Despite rising costs, the company maintained a consistent revenue stream from 2024 to 2025, demonstrating its ability to compete in the market. This is consistent with research showing that, in spite of cost fluctuations, informal merchants can modify pricing and market reach to maintain revenue (Akanni & Adetayo,2011;Ogunniyi et al., 2021). Strong financial performance is demonstrated by Return on Investment (ROI), which ranges from 2.31 to 3.82 and indicates how much profit the company produces per naira of total costs. .

The company made about four times its total cost in profit in 2022, which had the highest ROI. This was probably because sales income was higher than costs. Even though the return on investment dropped down in 2023, it stayed more than 2.0 every year, suggesting that the business kept producing a profit (Adebisi et al., 2020; Chukwu et al., 2020). A high and sustained ROI suggests that sellers are effectively transforming their investments into profit year after year.

Overall, the plank selling business demonstrates significant resilience and profitability, despite increasing operational costs. The high return on investment and rising return on fixed capital show that the company keeps turning its investments into profits and uses its money and assets wisely over timber. This supports studies that suggests investing in productive assets helps improve income in informal companies (Olajide & Adeoye, 2021; Gbigbi et al., 2024). When looking at the years 2020 to 2025, throughout 2021 and 2022, the increase in revenue was quicker than the increase in total costs, which led to higher profitability and better return on investment in 2022 compared to 2021.

Although total and variable costs peaked in 2023, revenue remained robust, resulting in a slight decline in return on investment. This indicates that the company maintained profitability despite the difficulty in controlling expenses. Revenue peaked in 2024–2025, and despite high overall costs, profits were robust. The increasing ROFC in recent years suggests better results.

Results on technical efficiency of wood marketers. Table 3 presents the technical efficiency estimates of wood marketers in the study area using both the Ordinary Least Squares (OLS) and Stochastic Frontier Maximum Likelihood Estimation (MLE) models.

Table 3. Technical Efficiency of Timber business in the Study area (N=90)

Variable	OLS Coefficient	MLE Coefficient	Standard Error (MLE)	t-value (MLE)
Dependent Variable: Log(Output)				
Labour (X1)	0.372	0.310***	0.082	3.78
Capital (X2)	0.456	0.401***	0.091	4.41
Transportation (X3)	0.289	0.242***	0.073	3.31
Fuel (X4)	0.198	0.176**	0.064	2.75
Processing (X5)	0.334	0.291***	0.085	3.42
Maintenance (X6)	0.124	0.097*	0.052	1.87
Inefficiency Model (u_i)				
Age (Z1)	-0.115	-0.103**	0.047	-2.19
Experience (Z2)	0.078	0.062**	0.028	2.21
Education (Z3)	0.092	0.081**	0.033	2.45
Gender (Z4)	-0.034	-0.029	0.021	-1.38
Variance Parameters				
Sigma^2 (σ^2)	-	0.058***	0.009	6.44
Gamma (γ)	-	0.76***	0.045	16.89
Model Diagnostics				
Log-Likelihood Function	-	-52.37	-	-
LR Test (χ^2)	-	28.64***	-	-
Technical Efficiency (TE)				
Mean TE	-	0.82	-	-
Minimum TE	-	0.60	-	-
Maximum TE	-	0.95	-	-

Source: own research based on field survey, 2026

* = Significant at 10%
** = Significant at 5%
*** = Significant at 1%

Although both approaches indicate that the production variables positively influence output, the stochastic frontier model provides a more reliable estimate because it distinguishes technical inefficiency from random shocks beyond the marketers' control. Consequently, the MLE results are more appropriate for interpreting the production behaviour of wood marketers.

All production inputs have positive coefficients, according to the calculated production function, meaning that wood marketers' output grows when these inputs are increased. Labour had a positive and highly significant effect ($\beta = 0.310$, $p < 0.01$), meaning that a 1% increase in labour input enhances wood output by approximately 0.31%, holding other factors equal. With the highest production elasticity of all inputs, capital also had a positive and highly significant impact on output ($\beta = 0.401$, $p < 0.01$).

The coefficient for transportation cost was positive and statistically significant ($\beta = 0.242$, $p < 0.01$), indicating a considerable contribution of efficient transportation to higher output.

Additionally, fuel cost was positive and significant ($\beta = 0.176$, $p < 0.05$), suggesting that fuel availability facilitates industrial activities through processing, transportation, and machine operation **.**Production was greatly enhanced by processing operations ($\beta = 0.291$, $p < 0.01$). The maintenance cost was significant at the 10% level ($p < 0.10$) and had a positive coefficient ($\beta = 0.097$).

The inefficiency model offers further information about the variables affecting technical inefficiency in wood merchants. The coefficient for age was negative and statistically significant ($\beta = -0.103$, $p < 0.05$), suggesting that older marketers are less likely to be inefficient technically.

On the other hand, experience showed a positive and significant relationship ($\beta = 0.062$, $p < 0.05$), suggesting that more years of experience were linked to higher levels of technical inefficiency.

Additionally, education demonstrated a positive and significant relationship ($\beta = 0.081$, $p < 0.05$), indicating that greater technical inefficiency was linked to higher educational attainment**.**

Gender did not significantly affect the technical efficiency of wood marketers in the study area, as evidenced by the negative but statistically insignificant coefficient ($\beta = -0.029$). This implies that when given equivalent manufacturing resources and operating conditions, male and female marketers perform similarly.

The stochastic frontier model is validated by the calculated variance parameter ($\sigma^2 = 0.058$, $p < 0.01$) due to the substantial fluctuation in the composite error term resulting from both technical inefficiency and random disturbances. Additionally, the gamma estimate ($\gamma = 0.76$, $p < 0.01$) shows that variations in technical efficiency account for about 76% of the output variation among wood marketers, with the remaining 24% coming from uncontrollable random factors like weather, market fluctuations, or measurement errors. Improving managerial efficiency has a significant potential to boost productivity, as this high gamma value shows.

Discussion of technical efficiency result. According to this research, labor is still an essential component of wood marketing operations, especially when it comes to

loading, unloading, sorting, processing, and handling timber products. The outcome is consistent with research by Yusuf & Kareem (2023) and Akinola et al. (2021), which found that labor greatly boosts production in small businesses.

This suggests that marketers' productivity is significantly boosted by increasing investment in working capital, equipment, storage facilities, and business processes. With enough money, marketers can expand their marketing initiatives, buy more timber, and use better processing methods, all of which boost output. Akinbode & Dada (2022) reported similar results, identifying capital investment as a significant factor in determining firm productivity

Since timber products are substantial and require transit from forest locations to markets, advances in transport services reduce delays, prevent product losses, and promote prompt delivery to clients. The study of Adewuyi et al. (2021), who highlighted the significance of transportation infrastructure in enhancing the performance of forest product firms, is supported by this finding

Fuel has a positive impact on output, but its coefficient is smaller than that of labor and capital, indicating that its influence is only mild. However, if improperly managed, rising fuel prices may result in higher operating expenses and less effective marketing (Agbonlahor, 2010).

This finding suggests that adding value to timber products by cutting, size, grading, packaging, and other processing procedures improves their marketability and commercial worth. Therefore, while producing more marketable wood products, efficient processing allows marketers to earn larger returns. This result is in line with FAO (2022) observations that value addition is still a major factor in forest product value chains' competitiveness and profitability.

The outcome implies that routine repair of vehicles, machinery, and processing equipment enhances operational continuity and decreases output interruptions, even though its impact was less than that of the other production inputs. However, the lower degree of significance suggests that maintenance influences production in a supportive rather than a dominant manner.

This implies that older marketers are better able to make use of existing resources than younger ones due to their acquired practical knowledge, stronger business networks, and more familiarity with market conditions.

This study may suggest that better educated marketers are less effective at managing wood marketing operations because they spend more time on other business tasks or administrative duties, despite the fact that it seems to go against popular wisdom. It might also imply that without supplementary technical and administrative abilities unique to the timber industry, formal education is not enough to increase productivity.

This surprising outcome might be a reflection of more seasoned marketers' propensity to stick with conventional company procedures and become less receptive to new technologies, creative marketing techniques, or contemporary management techniques. Similar results have been shown in investigations where opposition to

innovation prevented extended experience from always translating into increased production efficiency.

The stochastic frontier model offers a substantially better match than the traditional OLS model, as further shown by the likelihood ratio statistic (LR = 28.64, $p < 0.01$). This justifies the inclusion of technical inefficiency effects in explaining variances in wood marketing performance.

Lastly, wood marketers attained a mean technical efficiency of 0.82, with efficiency scores ranging from 0.60 to 0.95, according to the predicted technical efficiency ratings. This suggests that, given the current state of technology and production resources, marketers are, on average, producing at around 82% of their capacity. As a result, there is still an efficiency gap of about 18%, indicating that output could be significantly increased without necessarily raising input levels through better managerial techniques, better distribution of production resources, adoption of efficient technologies, and improved operational management.

Constraints of wood marketers in the study area. The Table 4 presents the major challenges faced by wood marketers in the study area based on responses from 90 participants. The constraints are ranked according to the proportion of respondents who identified each issue as a problem.

Table 4. Constraints facing the timber business

Constraints	Yes (Frequency)	Yes (%)	No (Frequency)	No (%)	Rank
Inadequate power supply	89	98.9	1	1.1	1st
High cost of transportation	89	98.9	1	1.1	1st
Insufficient wood species	78	86.7	12	13.3	3rd
Inadequate credit facilities	77	85.6	13	14.4	4th
Government policy	36	40.0	54	60.0	5th

Source: own research based on field survey, 2026

Inadequate power supply and high cost of transportation are jointly ranked as the most severe constraints (1st position), with 98.9% of respondents identifying them as major problems. This indicates that almost all wood marketers are affected by unreliable electricity and expensive transport services. Poor power supply often forces marketers to depend on generators, which increases operational costs, while high transportation costs reduce profit margins and limit market expansion (Adetunji & Oseni, 2021).

Insufficient wood species is ranked third, with 86.7% of respondents reporting it as a constraint. This suggests that access to diverse and adequate wood resources is a major concern. Limited availability of wood species can restrict production and reduce the ability of marketers to meet customer demand.

Inadequate credit facilities are placed fourth, affecting 85.6% of respondents. This indicates that the majority of marketers have trouble getting the funding they need to

grow their businesses. It becomes difficult to invest in machinery, transportation, and large-scale wood purchases without enough credit.

Finally, government policy is ranked as the least severe constraint (5th position), although it still affects 40.0% of respondents. This implies that while some marketers experience challenges related to regulations, taxes, or policy restrictions, it is not as widespread as other constraints. The ranking analysis reveals that the most critical challenges affecting wood marketers are power supply and transportation costs, followed by limited wood resources and lack of credit access. Government policy, although relevant, has a comparatively lower impact (Adetunji & Oseni, 2021). Addressing these key constraints especially infrastructure and financial access would significantly improve the performance and profitability of wood marketers in the study area.

Conclusions and recommendations

Based on the findings of this study, it was concluded that wood marketing in Ikire Local Government Area is a profitable and viable economic activity with the potential to support livelihoods and contribute to local economic development. Although the level of technical efficiency among marketers is relatively high, it is not optimal. The average efficiency level of 82% indicates that there is still room for improvement in resource utilization and operational practices. Differences in efficiency among marketers are largely influenced by factors such as access to capital, labour utilization, education, and experience. The study also concludes that the performance of wood marketers is significantly affected by external challenges, particularly poor power supply and high transportation costs, which increase operational expenses and reduce profitability. Overall, while the business is sustainable and rewarding, addressing the identified constraints and improving managerial and technical capacity will further enhance productivity and efficiency in the sector.

The study recommend that in order to lessen reliance on generators, cut operating expenses, and improve the effectiveness of wood processing and marketing operations, the government should upgrade the electricity supply in the study area. In order to lower the cost of transporting wood goods, enhance market access, and boost marketers' profitability, it is also necessary to invest in improved road networks and transportation infrastructure. To help wood marketers grow their companies, buy new equipment, and increase their operating capacity, access to reasonably priced finance through soft loans and specialized financing schemes should be improved. Regular training and capacity-building initiatives should also be put in place to provide marketers better management and business skills, which will increase output and decrease technical inefficiencies. To guarantee a steady supply of timber resources and protect the industry's long-term sustainability, sustainable forestry techniques, such as tree planting and forest conservation, should be encouraged. Increasing youth involvement in wood marketing can also boost productivity by utilizing cutting-edge technology and creative business strategies. Lastly, in order to boost output, reduce

operational losses, and improve overall business performance, wood marketers should be urged to execute routine equipment maintenance and implement better processing technologies.

Funding

This section must detail all sources of financial support received for the conduct of the research and/or preparation of the article. Authors should list each funding agency, grant number, and the role of the funding body in the study design, data collection, analysis, interpretation, writing of the report, and the decision to submit the article for publication. If the research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors, authors should include the following statement: "This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors".

Declaration of Competing Interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper. The work was not sponsored by any organization.

Use of generative AI and AI-assisted technologies

Generative AI tools were used only for language editing and grammar improvement during the preparation of this manuscript .The authors reviewed and approved all final content.

References

Adaaja B.O., Akemien N.N., Alawiye M.A., Zaman E.Y., Yahaya U., Khidir H.Y. (2024). Economic and ecological sustainability of non-timber forest products (NTFPs) in Nigeria: A review. FUDMA Journal of Sciences, 8(6), 196–204.

Adebisi L.A., Olujobi O.J. (2020). Structure and performance of timber markets in Southwest Nigeria. Journal of Sustainable Forestry, 39(5), 401–415.

Adeniran A.O., Alabi O.S., Olaniyi F.O. (2022). Women's participation and enterprise sustainability in Nigerian informal sectors. African Journal of Business Management, 18(5), 55–64.

Adeogun A.A., Owoeye D.O. (2020). Influence of age on entrepreneurial performance in Nigerian informal markets. Journal of Small Business Studies, 15(3), 24–31.

Adetunji M.O., Oseni J.O. (2021). Constraints to timber production and marketing in Nigeria. International Journal of Forestry and Horticulture, 7(2), 25–36.

Adeyoju S.K. (2001). Forestry for national development: A critique of the Nigeria Situation. Proceedings of the 27th Annual conference of the forestry association of Nigeria, Abuja FCT, pp. 34–42.

Agbonlahor M.U (2010). Productivity dispersion and resources of technical in efficiency small holder timber mills in Ogun state Nigeria. Journal of Humanities, Social Sciences and Creative Arts, pp. 49–60.

Agwu A.E., Emeti C. (2019). Transportation and market performance of timber traders. International Journal of Forestry Economics, 12(4), 42–50.

Aina O.M., Salau S.A. (2023). Determinants of profitability in timber markets in Nigeria. Journal of Agribusiness and Rural Development, 4(58*),* 101–110.

Akanbi M.O., Akande S.O. (2019). Gender roles and income generation in wood product markets. Forest Policy Journal, 10(2), 15–23.

Akande S.W (2007). Estimation of cost return structure and technical efficiency in sawmilling industry in Ijebu division Ogun State, Nigeria. Journal of Forestry Research Management, 8: 64–79.

Akanni K.A, Adetayo A.O (2011). Estimation of cost return structure and technical Efficiency in sawmilling industry in ijebu division Ogun state, Nigeria. Journal of Forestry research and management, vol. 8, pp. 64–79.

Akindele S.O., LeMay V.M. (2021). Forest inventory and timber resource management in Nigeria. Forestry Studies Journal, 75(1), 15–28.

Akinyemi O., Oladipo F. (2023). Value chain analysis of timber industry in Nigeria. Journal of Agricultural Value Chain*, 6*(1), 70–84.

Arowosoge O.G.E., Tee N.T. (2021). Marketing efficiency and challenges of timber trade in Nigeria. Forest Economics Review*,* 13(2), 77–89.

Babatunde T.O; Babatunde O.O; Adejumo A.A, Okeleke S.O (2017). Cost and return structure in sawmill industry in Ijebu-ode, Ogun state. Journal of research forestry, wildlife and environment, vol. 9 (3).

Babatunde R.O., Ayanwale A. (2021). Business experience and profitability in rural trade. Journal of Rural Entrepreneurship, 9(1)*,* 28–36*.*

Babatunde T.O., Babatunde O.O., Babatunde K.O., Aduloju A.R., Oluwalana T., Inyang V. (2021). Profitability, marketing efficiency and value addition of timber industry in Ife East Local Government of Osun State, Nigeria*.* Journal of Forestry and Wood Economics, 5(2), 45–59.

Chukwu O., Nwosu P., Uche C. (2020). Education and financial performance in informal enterprises. Journal of Development Economics*,* 8(3), 67–74, p. 70.

Cumming ham (2005). Productivity dispersion and resources of Technical in efficiency in smallholder timber mills in Ogun State Nigeria. Journal of Humanities, Social Science and Creative Arts, pp. 49-60

Donkor A.A., Ameyaw B., Appau K. (2021). Age and growth performance of small business owners in Ghana. Business and Economics Review, 14(2), 21–30.

Eze C.C., Okoro O.I., Nnaji F. (2020). Transport capacity and revenue outcomes in forest product markets. Journal of Transport Economics, 7(4), 11–20.

Gbigbi T.M., Ohwo O.A., Igah J.U. (2024). Credit impact on profitability and marketing efficiency of sawn wood marketers*.* Kastamonu University Journal of Forestry Faculty, 24(2), 168–181.

Ibrahim A.R., Aliero H.M. (2019). Education and entrepreneurial success in informal sectors. Small Enterprise Research Journal, 6(2), 39–47.

Johnson S.B., Akinlalu O.R., Awoseyila F. (2023). Investigating the controlled wood harvesting efficiency of logging operation in Akure Forest Reserve. International Journal of Research and Scientific Innovation, 10(4), 112–120.

Johnson S.R (2013).Forestry and the Nigerian Economy, University Press, Ibadan, Nigeria, pp. 308.

Kabir G.B., Idumah F., Awe F., Odediran F.A., Ukoh P.A. (2024). Analysis of technical efficiency of sawmill industry in Ogbomoso area of Oyo State, Nigeria: A stochastic frontier approach. Ethiopian Journal of Environmental Studies and Management, 17(3), 210–222.

Ogunjinmi A.A., Aiyeloja A.A. (2021). Efficiency of timber marketing and forest resource utilization in Nigeria. Nigerian Journal of Forestry, 51(1), 23–35.

Ogunniyi L.T., Adebayo O., Olaleye S. (2021). Capital and revenue generation in small business sectors. Journal of Economic Transactions, 13(1), 72–81, p. 76.

Ogunwusi A.A. (2020). Wood utilization and sustainable forest management in Nigeria. Journal of Forestry Policy and Economics, 12(1), 30–42.

Ojo A.O., Adekunle V.A.J. (2022). Forestry resource utilization and economic contribution in Nigeria. Journal of Forestry Research, 33(1), 55–67.

Olagunju K.O., Salman K.K. (2022). Resource use efficiency in forest-based enterprises. Nigerian Agricultural Journal, 53(2), 66–78.

Olajide T.I., Adeoye O.L. (2021). Labor force and enterprise productivity in rural markets. African Business Journal, 11(3), 55–63.

Olatunji B.T., Idris S. (2024). Market structure and efficiency of timber marketing in Nigeria. Journal of Environmental Economics, 11(1), 140–152.

Olawumi A.C., Okunola (2015). Development of the Nigerian Particle Board Industry, Ph.D. Thesis, Department of Forest Resources Management, University of Ibadan, 317 pp.

Olorunnisola A.O. (2022). Wood technology development and efficiency in Nigeria. Wood Science Journal, 14(2), 55–68.

Osabohien R., Udu A.A., Nadeem M.A. (2019). Private ownership and business innovation in Nigerian informal economy. International Journal of Entrepreneurship, 10(4), 90–102.

Taiwo O.O., Afolabi K. (2022). Operational capital and profitability of SMEs in Nigeria. Journal of Emerging Markets, 17(6), 44–53.